CLAIMS

1. An accelerometer having

a plate-like base made from an electrically non-conductive material,

an outer substantially planar, ring-like, support frame fixedly bonded to the base,

an inner substantially planar, ring-like, support frame flexibly suspended within the outer frame by mounts connecting the inner frame to the outer frame so that the inner frame is spaced from the base and co-planar with the outer support frame,

a substantially planar plate-like proof mass moveably mounted in the inner support frame which is co-planar therewith,

four or more flexible mounting legs each co-planar with the proof mass and inner support frame,

with each mounting leg being connected at one end to the proof mass and connected at another end to the inner support frame so that the proof mass is mounted for linear movement in a sensing direction in the plane containing the outer support frame, inner support frame, proof mass and mounting legs, in response to acceleration change applied to the accelerometer,

with the mounting legs extending substantially perpendicularly to the sensing direction,

and with the flexible suspension of the inner support frame reducing compressive and/or tensile forces on the mounting legs as a function of temperature on the accelerometer.

2. An accelerometer according to Claim 1, wherein the outer support frame is anodically bonded to the base.

3. An accelerometer according to Claim 2, wherein the base material is glass.

4. An accelerometer according to Claim 3, including a plate-like cap, made from an electrically non-conductive material, anodically bonded to the outer support frame.

5. An accelerometer according to Claim 4, wherein the cap material is glass.

6. An accelerometer according to Claim 5, including a plurality of interdigitated capacitor fingers fixedly mounted, in a gaseous medium, in the inner support frame for sensing linear movement of, and for providing gaseous medium squeeze damping for, the proof mass in the sensing direction, with the fingers, proof mass, mounting legs, inner support frame and outer support frame being co-planar and formed from a single plate of mono crystalline silicon.

7. An accelerometer according to Claim 6, wherein the gaseous medium is air, nitrogen or neon

8. An accelerometer according to Claim 7, wherein the fingers comprise fixed first, second, third and fourth arrays of laterally spaced fingers extending substantially perpendicularly to the sensing direction and away from the inner support frame towards the proof mass, with the first and second arrays being located on one side of the proof mass and with the third and fourth arrays being located on the opposite side of the proof mass, and moveable fifth, sixth, seventh and eighth arrays of laterally spaced finger extending substantially perpendicularly to the sensing direction from and attached to the proof mass towards the inner support frame, with the fifth and sixth arrays being located on said one side of the proof mass and interdigitated respectively with the first and second arrays and with the seventh and eighth arrays being located on said opposite side of the proof mass and interdigitated respectively with the third and fourth arrays, with the interdigitation of the first and fifth arrays and of the third and seventh arrays being at a first offset in one direction in the sensing direction from a median line between adjacent fingers in the first, second, third and fourth arrays, and with the interdigitation of the

second and sixth arrays and of the fourth and eighth arrays being at a second offset equal and in the opposite direction to the first offset.

9. An accelerometer according to Claim 8, including means for providing a first drive voltage to the first and third offset arrays of fingers and a complementary opposite second drive voltage to the second and fourth offset arrays of fingers such that the interdigitated fingers provide for the proof mass sensing of displacement in response to acceleration applied to the accelerometer, drive and damping of displacement, and means for providing pulse width modulation of the first and second drive voltages with a constant frequency to provide an electrostatic restoring force on the proof mass according to

$$F = \frac{CV^2}{2d}$$

where F is the restoring force, C is the capacitance, V is the voltage between the first and second offset arrays of fingers and d is the capacitance gap between the fingers.

10. An accelerometer according to Claim 9, wherein the proof mass, mounting legs, inner and outer support frames and interdigitated fingers are formed by dry etching from a plate of silicon which is orientated in the [111] or [100] crystal plane.

11. An accelerometer according to Claim 10, wherein the outer support frame has a substantially rectangular ring-like shape surrounding a first inner open area in which is mounted the inner support frame via two said mounts spaced apart in the sensing direction and each connecting one side of the outer support frame to one side of the inner support frame.

12. An accelerometer according to Claim 11, wherein the inner support frame has a substantially rectangular ring-like shape surrounding a second inner open area in which is located the proof mass which has a substantially rectangular shape, and wherein the mounting legs extend substantially perpendicularly to the sensing direction in spaced array, with at least two legs extending between a first inner wall of the inner

support frame defining the second inner open area and a facing first outer wall of the proof mass and with at least two legs extending between an opposing second inner wall of the inner support frame defining the second inner open area and a facing second outer wall of the proof mass.

13. An accelerometer according to Claim 12, wherein the mounting legs have high compliance in the sensing direction and low compliance in other directions.

14. An accelerometer according to Claim 13, wherein the outer support frame, first, second, third and fourth arrays of fingers are anodically bonded to the base and wherein the mounting legs, proof mass, inner support frame and fifth, sixth, seventh and eighth arrays of fingers are spaced from the base.

15. An accelerometer according to Claim 14, including at least four earth screens located with the second inner open area, each being associated with and partially surrounding a respective one of the first, second, third and fourth arrays of fingers, being operable to shield the arrays of fingers from the inner support frame and being electrically insulated from the inner support frame.

16. An accelerometer according to Claim 15, wherein the earth screens are fixedly mounted by anodic bonding to the base.

17. An accelerometer according to Claim 16, wherein the means for providing the first and second drive voltages and for providing pulse width modulation thereto include a mark to space generator for receiving a constant fixed reference voltage V_{ref} and for supplying complementary first and third drive voltages which together do not exceed V_{ref} to the first and third offset arrays of fingers and to the second and fourth offset arrays of fingers respectively, a pre-amp for receiving an output voltage from the proof mass corresponding to displacement thereof, a demodulator for receiving and demodulating an output from the pre-amp, an integrator/loop filter for receiving, integrating and filtering an output from the demodulator and for in turn feeding a drive signal to the mark to

space generator and a differential amplifier with low pass filtering for monitoring the first and second drive voltage values.

18. An accelerometer according to Claim 17, wherein the demodulator includes monostable circuits for limiting the pulse width of reference signals from the demodulator.

19. An accelerometer substantially as hereinbefore described and as illustrated in any one of Figures 3 to 15 as modified or not by Figure 17 of the accompanying drawings.